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PHILOSOPHICAL TRANSACTIONS.

X. *On Platina and native Palladium from Brasil.* By William Hyde Wollaston, M. D. Sec. R. S.

Read March 22, 1809.

ALTHOUGH platina has now been known to mineralogists for more than sixty years, yet it had not been discovered in any other places than Choco and Santa Fé, whence it was originally brought, until about two years since M. VAUQUELIN discovered it in some gray silver ores from Guadalcanal in Estremadura. In analysing these ores, he found some fragments that contained as much as one tenth of their weight of platina, but he did not find it accompanied by any of the new metals that have lately been discovered in the Peruvian ore of platina.

The specimen which I am now about to describe, is derived from a third source, and it is rendered the more interesting by having grains of native palladium mixed with it. This new mineral has lately been received from the gold mines in Brasil, by H. E. Chev. DE SOUZA COUTINHO, ambassador from the court of Portugal, resident in this country, and I am in

hopes that some account of it may be acceptable to the Royal Society, although the analysis must necessarily be very imperfect, from the small quantity to which my experiments have unavoidably been confined.

The general aspect of this specimen is so different from the common ore of platina, that I could form no conjecture of what ingredients it might be found to consist. Its appearance was such indeed, as at first sight to induce a suspicion of its not being in a natural state, for it had very much the spongy form which is given to platina from imperfect attempts to render it malleable by means of arsenic.

One circumstance, however, occasions a presumption that no art has been employed in giving the grains their present appearance; as upon close inspection many small particles of gold are discernible, but there is none of the magnetic iron sand with which the Peruvian ore abounds, nor any of the small hyacinths, which I have formerly noticed as accompanying that mineral.*

It is very well known, that the common ore of platina in general consists of flattened grains, that appear so much worn at their surface, as to be in a considerable degree polished, and the roughness observable in some of the larger grains arises from concave indentations of a reddish brown or black colour. The Brazilian platina, on the contrary, has no polish, and does not appear worn; but most of the grains seem to be small fragments of a spongy substance, and even those which are yet entire and rounded on all sides, present a sort of roughness totally different from that of the former, as their surface consists of small spherical protuberances closely coherent to each

* Phil. Trans. for 1805, p. 318.

other, with the interstices extremely clean, and free from any degree of tarnish.

The first portion that I employed for solution was taken without any selection, and being digested with a small quantity of nitro-muriatic acid, two of the grains were acted on much more rapidly than is usual with platina, and seemed to give a redder colour than that metal alone. These grains were consequently taken out, washed, and reserved for separate examination, and the solution was allowed to proceed till the rest were entirely dissolved. By the addition of muriate of ammonia an abundant precipitate was formed of a bright yellow colour. This precipitate was evidently platina, and its colour satisfied me that the grains had not been brought into their present state from Peruvian platina by means of arsenic; for where arsenic has been employed, I have observed that the iridium contained in that ore is rendered more soluble than before, and thence communicates its red colour to the precipitate.

From the grains thus examined, there appeared not to be any iridium dissolved, nor any black powder containing iridium undissolved.

I next endeavoured, by prussiate of mercury, to ascertain the presence of palladium, but though a precipitate which occurred indicated a certain quantity, it remained doubtful whether it was derived from the grains of platina themselves, or from the two small fragments that had been in part dissolved before they were separated from the rest.

By addition of ammonia to the solution, no iron was precipitated; and when the solution was afterwards allowed slowly to evaporate, I could discern no crystals or colour that I could

ascribe to the presence of rhodium. In short, it seemed that these grains are really native platina nearly pure.

In order to discover whether the grains themselves contained any portion of gold, I selected three of the largest weighing together eight grains and a half; and after a solution and precipitation, as before, by muriate of ammonia, I added a solution of green sulphate of iron, and obtained a precipitate of gold. It was, however, far too small in quantity to be estimated with correctness, but certainly did not exceed the $\frac{1}{200}$ of a grain. This, it is to be observed, is another circumstance in which the present mineral differs from the Peruvian ore of platina, which I believe never contains (in the ore itself) the smallest quantity of gold.

In this experiment also, I tried to detect the existence of palladium in the solution, and by prussiate of mercury again ascertained its presence; but it was in too small quantity for estimating the proportion it bore to the whole mass.

It may deserve to be remarked, that though neither the Peruvian nor Brazilian grains of platina contain any silver, yet the gold which accompanies them is in each instance so much alloyed with silver, that from about thirty small scales of gold picked from Peruvian platina, weighing two grains, I obtained as much as four tenths of a grain of silver, or one fifth part of their weight.

Native Palladium.

The two fragments, that had been separated from the first solution, next claimed my attention, and evidently deserved a careful examination. They were each placed in a drop of nitric acid, and each communicated a deep red colour, which,

by the tests of prussiate of mercury and green sulphate of iron, I was satisfied arose from palladium. The smaller fragment was then divided, and one portion allowed to remain in the acid till it seemed completely dissolved, and the other examined by the blow-pipe. The utmost heat that could be given, appeared to have no effect; but when a small piece of sulphur was applied to it, it fused instantly; by continuance of the heat, it parted with the sulphur, and became completely malleable. In short, it perfectly resembled palladium; and as it retained its brilliancy in cooling, I judged it to be nearly pure.

But as the surfaces which had been acted upon by nitric acid had a degree of blackness, that might be owing to some insoluble impurity, I have since that time dissolved the larger fragment for the sake of discovering the cause of this appearance. Hot nitric acid dissolved by far the greatest part; but there remained a black powder on which a fresh addition of this acid alone had no further effect. But when a drop or two of muriatic acid was added, the whole was very soon dissolved. By the addition of muriate of ammonia, it became evident from the precipitate that the residuum was principally platina. But this precipitate, instead of being yellow, had the deep red colour, which is usually occasioned by the presence of iridium. The platina reduced from this precipitate was also too black for pure platina, and when it was again dissolved, the solution was of a deep red, and the precipitate by muriate of ammonia red, as before; so that although the grains of Brazilian platina appear to be free from iridium, as well as from many other impurities that form part of the Peruvian ore, yet the grains of native palladium that accompany them, afford a trace

of this ingredient, and occasion a presumption that osmium and rhodium may hereafter appear, when we can obtain this mineral in larger quantity.

Since the whole weight of metal employed in the last experiment did not exceed $1\frac{2}{10}$ grain, it is in vain to attempt to estimate the proportion of the ingredients, but if I am near the truth, in considering the quantity of the red precipitate as about one fifth of a grain, of which less than half is platina, those who are best acquainted with the intense colouring power of iridium may endeavour to form a conception of the extremely small quantity that can be present.

As soon as I had ascertained the existence of native palladium, I endeavoured, by examination of its external characters, to distinguish its appearance from that of the surrounding substances, and I found it by no means difficult, although no difference of colour could be discerned. Having remarked that the larger fragment appeared rather fibrous, and that the fibres were in some degree divergent from one extremity, I examined the remainder of the small specimen which had originally been given to me, and by this peculiarity of structure I soon detected a third fragment, which upon trial proved to be the same substance. By favour of the Chev. DE SOUZA I was also permitted, with this view, to examine the specimen which remained in his possession, and had soon the satisfaction of discovering two more fragments of the same mineral, and as I was in no one instance deceived in my choice, by attending to the radiating fibres, I am in hopes that this external character will enable persons to distinguish that metal, in situations where they have not an opportunity of deciding by chemical experiment.